

REMARKS

Claims 1-61 are pending and at issue in this patent application, with claims 62-66 added by amendment above. Of these, claims 1, 20, 35, 40, 45, 51 and 57 are independent. The office action has rejected claims 1-44 and 57-61 under 35 U.S.C. § 112. The office action has rejected claims 1, 7, 11, 12, 15-22, 26, 27, 29-34, 40, 43, 45-61 as anticipated by Killpatrick and claims 35-39 as anticipated by Maleki. The office action has also rejected claims 2-6, 8-10, 13-14, 23-25, 28, 42 and 44 as obvious in light of combinations involving Killpatrick and Ball, Hicks, Ho, or Weisbuch. Applicant respectfully requests reconsideration and favorable action in this case.

Applicant respectfully traverses the rejection of claims 1-44 and 57-61 as being indefinite under 35 U.S.C. § 112. The office action rejects the independent claims stating that "no structure is provided that is capable of varying the gap in the resonator." Yet, the office action also states that the case references "a variable gap that varies in response to a sensing surface." (Emphasis added). In any event, the suggestion that necessary structures and structural relationships exist, but have not been claimed, has no basis from the specification, which nowhere suggests such criticality. Indeed, the specification provides numerous different examples of the claimed subject matter, which suggests against the office actions assertions under 35 U.S.C. § 112, ¶2. The rejections are traversed as improper.

Applicant respectfully traverses the rejection of claim 1, 7, 11, 12, and 15-19 as anticipated by Killpatrick et al. (U.S. Patent No. 5,663,792).

Independent claim 1 recites, in part, an optical sensor apparatus for measuring a measurable parameter comprising an optical resonator having a waveguide comprising a first dielectric, a cavity defining a variable gap comprising a second dielectric different than the first dielectric, and a sensing surface positioned to vary the variable gap in response to changes in the measurable parameter at the sensing surface. Killpatrick does not disclose a waveguide, a cavity defining a variable gap, or a sensing surface and therefore cannot anticipate claim 1 or any of claims 7, 11, 12, 15-19, depending therefrom.

Claim 1 as amended recites an optical resonator comprising a waveguide, similar to the previous claim 2. The office action (in the rejection of claim 2) has already recognized that Killpatrick does not teach a waveguide. While Killpatrick discloses mirrors used to

direct two counter-propagating light beams, the propagation in Killpatrick is not via a waveguide, but rather appears to be via free space propagation.

The office action also cites Killpatrick column 4, lines 30-40 as teaching a variable gap. However, these lines do not. Per these lines, Killpatrick's resonator can have different optical path lengths, e.g., by physically moving element 22. Yet, the ability to shorten or lengthen the physical distance of a propagation path between two mirrors is neither a cavity nor a variable gap, as recited. The free-space propagation region between the mirrors in Killpatrick is quite different from the examples illustrated in FIGS. 4-18, for example. Nevertheless, to clarify the recited subject matter, claim 1 now recites an "optical resonator having a waveguide comprising a first dielectric [and] a cavity defining a variable gap comprising a second dielectric different than the first dielectric." This amendment further clarifies that the recited subject matter is not taught by the prior art.

Claim 1 also recites "a sensing surface positioned to vary the variable gap in response to changes in the measurable parameter at the sensing surface such that the repetition rate of the pulsed laser energy changes in response to changes in the measurable parameter." Killpatrick does not disclose any pulsed laser energy, much less any structure that affects the repetition rate of the pulsed laser energy. While Killpatrick may disclose two counter propagating laser beams, there is no disclosure of a pulsed laser energy whose repetition rate is variable.

The office action rejects various dependent claims that recite particular waveguide structures, based on a suggested combination of Killpatrick and other references. Not only does Killpatrick fail to teach the recited subject matter, none of the prior art, taken alone or in combination, teaches the recited subject matter.

The office action rejects previous claim 2, directed to a waveguide, as obvious over the combination of Killpatrick and Ball or Hicks. That rejection, however, is improper, as it does not establish *prima facie* obviousness, as required, but instead is the kind of impermissible hindsight that the Federal Circuit has cautioned against numerous times.

To establish *prima facie* obviousness, there must be some teaching, suggestion, or motivation from the prior art to make the proposed combination or modification. As explained by the Federal Circuit in In re Rouffet:

As this court has stated, virtually all [inventions] are combinations of old elements. Therefore, an examiner may often find every element of a claimed invention in the prior art. If identification of each claimed element in the prior art were sufficient to negate patentability, very few patents would ever issue...To prevent the use of hindsight based on the invention to defeat patentability of the invention, this court requires the examiner to show a motivation to combine the references that create the case of obviousness. In other words, the examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed.

In re Rouffet, 47 U.S.P.Q.2d 1453, 1457 (Fed. Cir. 1998) (citations omitted and emphasis added). As further explained in the In re Rouffet decision:

This court has identified three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art. In re Rouffet. at 1458.

The office action points to none of these sources for a motivation or suggestion to use a waveguide in Killpatrick. And, as such, the obviousness rejection is legally flawed and improper.

The office action summarily suggests that it would have been obvious to use “means for guiding laser light” in Killpatrick. Yet, the office action does not point to the prior art for that suggestion. The lack of any *prima facie* showing is particularly glaring considering that Killpatrick relies upon mirrors and free space propagation, and nowhere suggests a desire for adding the additional complexity and expense that would likely come from adding a waveguide. In fact, the office action appears to ignore the fact that both Hicks and Ball relate to fiber optic waveguides which, as would be known in the fiber optics field, require careful coupling of light into and out of the fiber. There is no suggestion of how one would hope to achieve such coupling with the Killpatrick mirrors, especially where it achieves no purpose of Killpatrick’s disclosure. There is certainly no expectation of success provided in the prior art for such a combination. The applicant notes that both the suggestion to try and the expectation of success must be found in the prior art, not in the applicant’s disclosure. See, e.g., Amgen Inc. v. Chugai Pharmaceutical Co. Ltd., 927 F.2d 1200, 1207 (Fed. Cir. 1991), citing In re Dow Chemical Co., 837 F.2d 469, 475 (Fed. Cir. 1988)).

Furthermore, it would appear that the fiber optic structures of Hicks and Ball would be incompatible with Killpatrick, as Hicks is directed to a fiber optic condition sensor and Ball is directed to a fiber laser. Thus, even assuming a suggestion to combine these waveguides with Killpatrick did exist, the waveguides would render Killpatrick inoperable for its intended purpose, as both Ball and Hicks teach fibers as resonant cavities, and placing a resonant cavity within the mirror ring of Killpatrick would hinder gyroscopic operation.

In short, the office action's suggestion that Killpatrick may be combined with either Hicks or Ball is improper.

The office action also rejects claims 9, 13, and 14 as obvious over Killpatrick in further view of Ho, which discloses a microdisc with a microcavity. The office action's suggestion to combine Ho with Killpatrick is equally deficient, as there is no suggestion to combine Ho's microcavity with the adjustable path length device and detectors of Killpatrick. There is no suggestion, for example, of how to use Killpatrick's mirrors in a triangular configuration with Ho's circular microdisc. Nor is there any suggestion of how to adjust the optical path length of the microcavity of Ho using Killpatrick's path length device 22. As with the previously discussed rejection, the purported combination is not suggested by the prior art.

The office action also rejects claim 10 as obvious over Killpatrick in view of Weisbuch, with Weisbuch disclosing a photonic crystal structure. Weisbuch teaches fabrication processes for creating photonic crystal structures. However, neither Killpatrick nor Weisbuch suggest or provide a motivation for combining the photonic crystal structure of Weisbuch with the laser gyro device of Killpatrick. The office action contends that the motivation for combination derives from a desire to provide "a suitable waveguide medium with desired properties." However, as mentioned above, none of the references, including Weisbuch, teach a desire to integrate a waveguide into the Killpatrick gyro. This purported combination is not suggested by the prior art.

In sum, it is clear that none of the prior art, alone or in combination, teaches the subject matter recited in claim 1. The rejection of claim 1, as well as the rejections of claims 2-10 and 12-19 depending therefrom, are all traversed for the reasons outlined above.

There are additional omissions from the office action that suggest that the office action has misread other recited subject matter as well. The applicants note some of these below.

Referencing claim 12, the Applicant notes that the office action suggests that detectors 24 and 26 detect a measurable parameter. However, Killpatrick describes these as light intensity detectors. See column 4, lines 26-32. There is no suggestion in Killpatrick of the sensing or measuring of parameters recited in claim 12.

Claim 15 recites a microsphere having a first and second hemisphere spaced apart by a variable gap, which is clearly not shown in Killpatrick, yet the office action determines that Killpatrick anticipates that subject matter.

Claim 16 recites a microsphere disposed within a cavity formed in a dielectric module, which is clearly not shown in Killpatrick, yet the office action determines that Killpatrick anticipates that subject matter, as well.

Applicant respectfully traverses the rejection of claims 20, 21-22, 26, 27 and 29-34 as anticipated by Killpatrick.

Independent claim 20, as amended, recites, in part, the optical sensor apparatus comprising an optical resonator having “a waveguide comprising a first dielectric, a cavity defining a variable gap comprising a second dielectric different than the first dielectric, and a sensing surface positioned to vary the variable gap in response to changes in the measurable parameter at the sensing surface, the optical resonator defining a resonant frequency that varies in response to variations in the variable gap.”

For similar reasons to those outlined above regarding claim 1, it is clear that none of the prior art, whether taken alone or in combination teaches the recited subject matter. As such the rejections of independent claim 20 and claims 21-31 and 33-34 depending therefrom, are traversed.

Applicant also respectfully traverses the rejection of claims 35-39 as anticipated by Maleki et al. (U.S. Patent No. 6,473,218).

Independent claim 35, as amended, recites, in part, an apparatus for measuring a parameter, wherein the measurable parameter is a physical parameter creating a change in a force applied to the sensing surface to vary the resonant frequency, examples of which are enumerated in claim 37.

Maleki does not disclose measuring a physical parameter nor does Maleki disclose applying a physical parameter to the sensing surface in order to vary a resonant frequency.

Maleki uses an RF modulator to affect the whisper gallery mode element, but this does not change a force applied to the sensing surface. Maleki does not anticipate claim 35 or any of claims 36-39, depending therefrom. Claims 35-39 and added claims 62-64 are in condition for allowance.

Applicant respectfully traverses the rejection of claims 40 and 43 as anticipated by Killpatrick.

Independent claim 40 recites an optical resonator having a sensing surface, a waveguide, and a cavity defining a variable gap. As noted above, the office action has already acknowledged that Killpatrick does not teach a waveguide (see the Examiner's comments regarding claim 2). *A fortiori*, Killpatrick cannot anticipate claim 40, which recites a waveguide. The anticipation rejection is improper on its face and should be withdrawn. Furthermore, for the same reasons as outlined above, there is no suggestion to modify Killpatrick to have a waveguide, as no *prima facie* obviousness has been established for such a combination.

Claim 40 and claims 41-44 and claims 65 and 66, depending therefrom, are in condition for immediate allowance.

Applicant respectfully traverses the rejection of claims 45-50 as anticipated by Killpatrick.

Independent claim 45, as amended, recites, in part, a method of sensing a measurable parameter, the method comprising providing a waveguide comprising a first dielectric and a cavity defining a variable gap comprising a second dielectric different than the first and that varies in response to changes in the measurable parameter, where variations to the variable gap alter the resonant frequency. Claim 45 further recites sensing changes in the measurable parameter based on the frequency of the propagated laser signal.

As outlined above, none of the prior art, alone or in combination, teaches the recited method. Claims 45-50 are in condition for allowance.

Applicant respectfully traverses the rejection of claims 51-56 as anticipated by Killpatrick.

Independent claim 51, as ameded, recites, in part, a method of sensing a measurable parameter, the method comprising providing a resonator comprising a waveguide formed of a first dielectric; providing a cavity defining a variable gap formed of a second dielectric

different than the first and that varies in response to changes in the measurable parameter; and propagating at least a portion of the pulsed laser signal through the resonator such that the repetition rate of the pulsed laser signal changes in response to variations in the variable gap. Claim 51 further recites sensing changes in the repetition rate in response to variations in the variable gap.

As discussed above, Killpatrick does not disclose providing a resonator comprising a waveguide, providing a cavity defining a variable gap that varies in response to changes in the measurable parameter and propagating at least a portion of the pulsed laser signal through the resonator such that the repetition rate of the pulsed laser signal changes in response to variations in the variable gap. Furthermore, Killpatrick does not disclose sensing changes in the repetition rate in response to variations in the variable gap. Therefore, Killpatrick cannot anticipate claim 51 or claims 52-56, depending therefrom.

Applicant respectfully traverses the rejection of claims 57-61 as anticipated by Killpatrick. Independent claim 57 is amended to recite an optical resonator having a cavity defining a variable gap. As discussed above, Killpatrick does not disclose a cavity defining a variable gap, and therefore, Killpatrick cannot anticipate claim 57 or claims 58-61, which depend from claim 57.

CONCLUSION

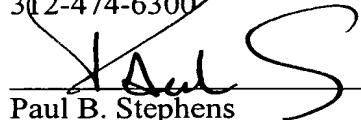
Applicant submits that this case is in a condition for immediate allowance. For the foregoing reasons and for other reasons clearly apparent, Applicant respectfully requests reconsideration and allowance of rejected claims 1-10, 12-31 and 33-66.¹

If the Examiner believes there are matters that can be discussed by telephone to further the prosecution of this application, feel free to contact the below signed representative.

Respectfully submitted,

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¹ Claims 11 and 32 are canceled by amendment above without prejudice to their reinstatement.

Application No.: 09/996,143

Docket No.: 30203/37899



ANNOTATED SHEETS SHOWING CHANGES

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Attorney Docket No.: 30203/37899
Title: Optical Sensor for Measuring Physical and Material
Properties
Applicants: Frick
Figs. 14A & 14B

Annotated Sheet

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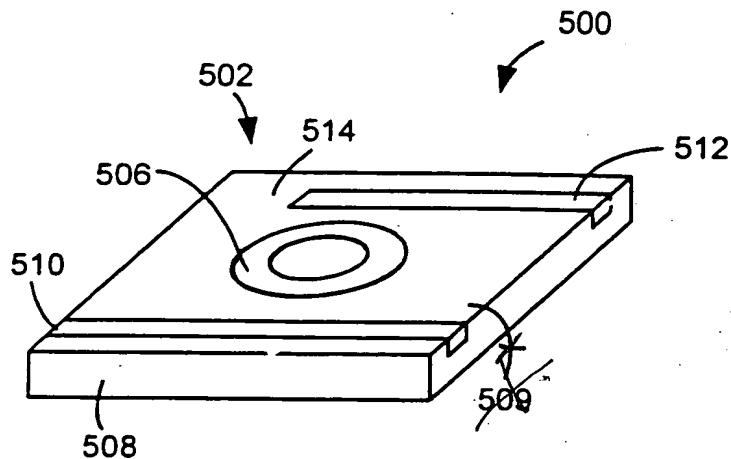


FIG. 14A

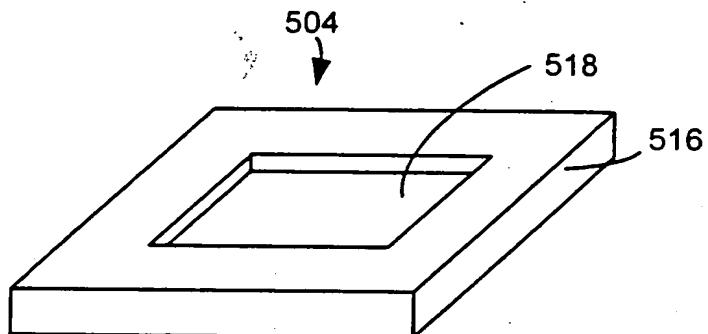


FIG. 14B



Attorney Docket No.: 30203/37899
Title: Optical Sensor for Measuring Physical and Material
Properties
Applicants: Frick
Figs. 15 & 16

Annotated Sheets

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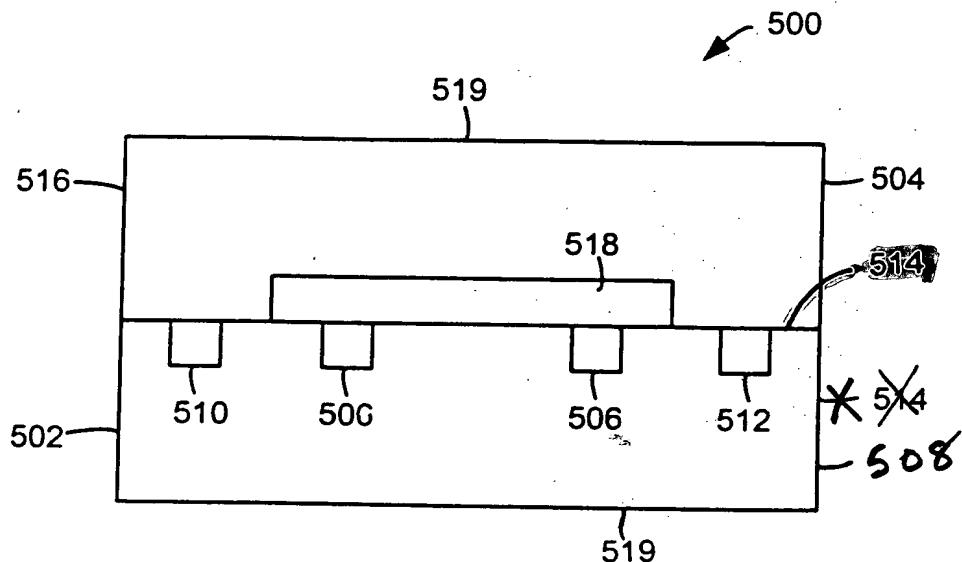


FIG. 15

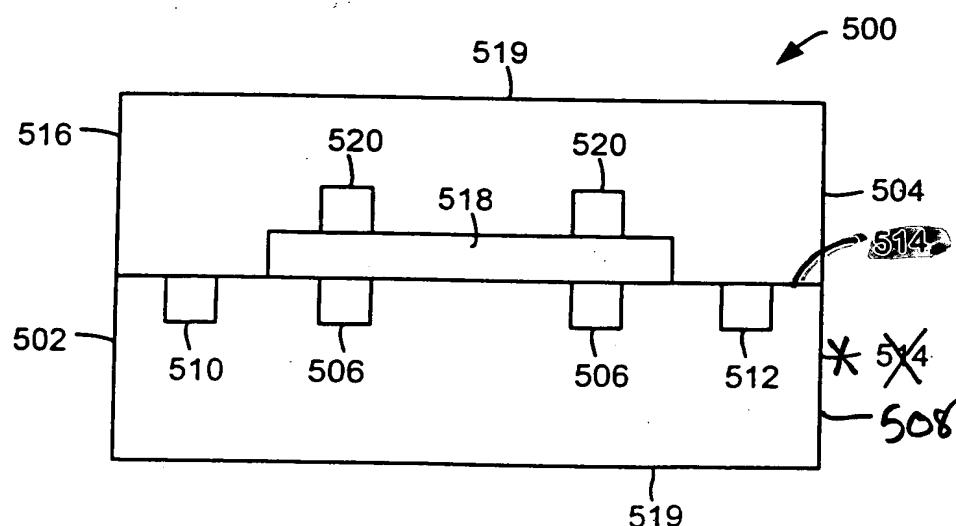


FIG. 16